by FRANCIS L. HIRT

# Patterns of Steel Output and Demand

## Recovery in Steel Output—Improvement in Durable Goods Demand—Long-Term Growth

THE year 1961 witnessed a marked recovery in steel production following the steady decline which began in the early spring months of 1960. From the December 1960 trough, which was 50 percent below March, output has moved irregularly higher; by early 1962, with orders flowing in large volume, the rate of production was up by more than two-thirds and was still rising. With the 1961 pattern the reverse of that in 1960, steel output last year approximated 98 million tons, 1 million tons below 1960 production.

In December, steel mills turned out 9.6 million tons of crude steel, a contra-seasonal rise of 10 percent over November, and some 4 million tons higher than the December 1960 figure.

The higher rate of output in the automobile industry; some recovery in business plant and equipment expenditures; a rising rate of residential and public construction; a normal rebuilding of steel stocks to support higher operations, plus perhaps some hedging by steel consumers against a possible steel strike later this year, are among the more important factors responsible for the recent improvement in steel output.

With early 1962 steel production already well above the 1961 monthly average, and favorable prospects for further increases in GNP over 1961, expectations are for a large advance in steel output over last year.

The present article provides some background material on longer term developments in steel output and consumption, in order to help assess the current market position of the industry. Historical output measures are presented, along with comparisons of steel to GNP and durable goods production; some of the major markets for steel are also considered.

### *Record of progress*

While instability has characterized steel output in the short run because of wide fluctuations in durable goods demand, the long-term trend has been upward. Over the fifty-odd years covered by the chart the average annual rate of growth in steel production has been approximately 2.6 percent, which is a little less than the growth rate exhibited by real GNP over the same period. In terms of tonnage, the expansion since 1909 has been 3½ times, from 26 million tons to a record 117 million tons in 1955. It may be noted that in the past few years steel output has not matched the high rates achieved in the 1955–57 period. In fact, in the 1958–61 period output has averaged some 10 percent below the average of the period 1950–57.

To serve the expanding needs of the economy, the steel industry increased its total steel-making capacity from 37 million tons in 1908 to more than 150 million tons in 1961. Large additions to capacity were made in each of the five decades, the largest occurring in the decade of the fifties, when additions totaled about 50 million tons of ingot capacity, or almost half of the increase since 1908. Substantial increases to finishing as well as raw materials facilities have likewise been made to balance out the expansion in ingot capacity.

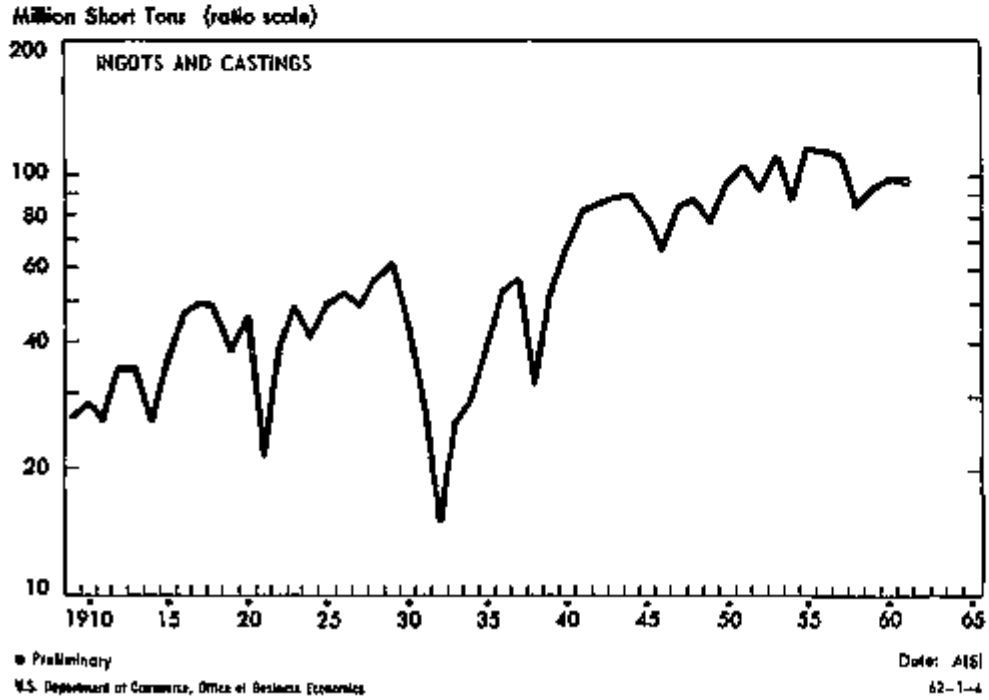
To cover the cost of the plant expansion and modernization of steel-making facilities during the fifties, the steel industry spent $11.3 billion, an average of $1.1 billion per year; these expenditures were equivalent to 10 percent of all manufacturing outlays for new plant and equipment, a higher proportion than for any other manufacturing industry except petroleum and chemicals.

### *Steel output and GNP*

The second chart gives another perspective to steel output by comparing it to constant dollar GNP and those parts of final output in which steel finds its chief uses, namely, total durable goods (consumer, producer and government) and construction.

The data are shown in terms of 5-year

**FIFTY YEARS OF STEEL PRODUCTION**

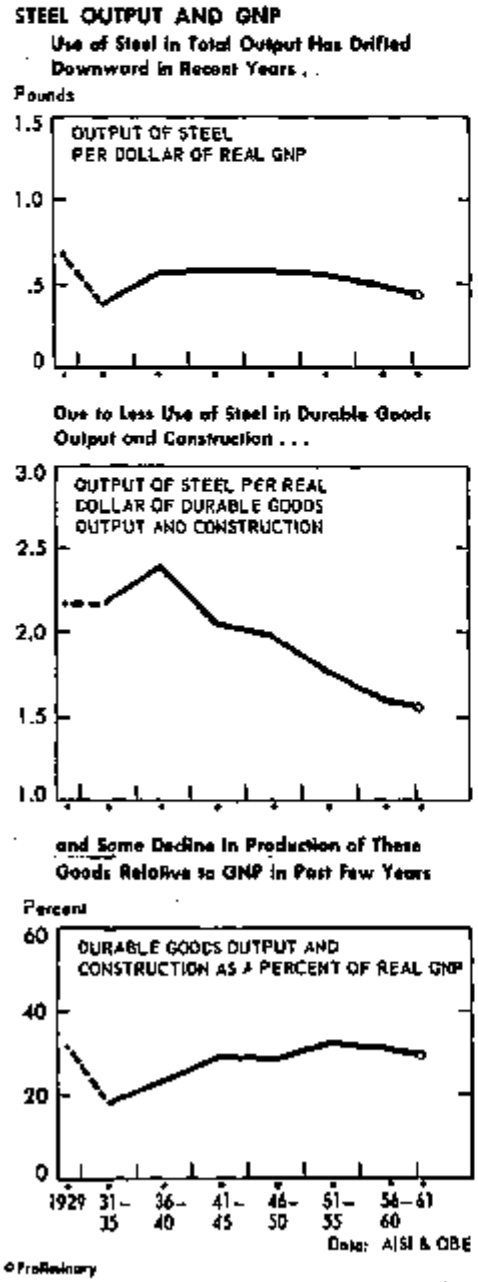





022107°—63——2

averages. It may be noted from the top panel that from the midthirties to the midfifties, the ratio of steel to GNP was roughly constant. Since the latter part of the fifties, however, the ratio has declined.

The second and third panels indicate that the approximate stability in the ratio that was evident from the depression years to the midfifties resulted from two offsetting trends. On the one hand, steel output has shown a declining trend relative to durable goods output plus construction, but simultaneously the output of these items was rising relative to GNP. Since the midfifties, however, both ratios have declined.




The bottom panel is illustrative of the long-term recovery of durable goods and construction from the unusually depressed rates of the early thirties back to a more normal relationship to GNP. A slight bulge is evident in the ratio during the war years and also during the early fifties, the latter under the influence of the Korean mobilization program. The small reduction since the middle 1950's may be considered as a short-term cyclical phenomenon, reflecting in particular relatively low rates of total investment and auto purchases. Even with the moderate pickup in investment and the more pronounced recent gain in automobile production, the ratio in the final quarter of 1961 had risen approximately back to the 1956–60 average.

### *Steel declining relative to durable goods*

The declining ratio of steel output to durable goods and construction, illustrated in the middle panel, represents two broad sets of factors. The more important reflects the changing character of durable goods output, from items with relatively little to relatively large amounts of "value added" per unit of steel consumed. The increased importance of consumer durables would be illustrative of such a trend, as would be the change in military procurement from steel-using materiel, such as tanks and ships, to electronics and missiles.

The other broad set of factors relates to the increased consumption of foreign steel, to the use of substitute materials such as aluminum, cement, and plastics, and perhaps more important, to the engineering and style changes that have reduced the weight of fabricated commodities and thus the quantity of steel per unit of output. Outstanding in this connection is the lower steel requirement for compact cars, which now constitute more than one-third of total passenger car output.

Steel has always been in competition with other materials but in the most recent period the displacement of steel with substitute or alternate materials seems to have become more significant, though relative magnitudes have to be kept in mind. In terms of tonnage, concrete and aluminum are the most important, though plastics is also gaining in market acceptance. These three materials compete directly with steel in many product lines, with aluminum particularly strong in the construction and transportation industries. Total use of aluminum and plastics is still small relative to steel, as discussed more fully below.

In the case of aluminum, consumption for all purposes in 1961 was less than 2½ million tons, whereas steel deliveries from mills to the domestic market amounted to 65 million tons. These data in terms of weight understate the importance of aluminum, since for a given unit of cubic volume aluminum is roughly one-third the weight of steel. Estimates by trade sources place the total steel tonnage replaced by the use of substitute materials at 2 million tons per year. It is significant that the market for these substitute products has continued to expand, at a time when steel output has lagged, though not exclusively as a result of the displacement of steel.

### *Steel output under full employment*

A correlation of steel production with GNP for the period from 1929 to date shows that for the prosperous peacetime years (excluding strike periods) when investment has been relatively high, steel production has expanded in accordance with a regular constant relation to the growth in GNP.

In 1961, the GNP was about $521 billion, an amount considerably short of that associated with full employment; steel production for the year amounted to 98 million ingot tons. Following an incomplete recovery in 1960 the year 1961 marked a cyclical trough in the first quarter and a subsequent upsurge. But despite the rising trend of production throughout the year durable goods output was still relatively low and the cyclical recovery was still far from complete. As the top panel of the second chart indicates, the position of the steel industry, as a consequence, was relatively depressed.

A reattainment of the historical relationship between steel production and full employment GNP would require a full recovery in investment demand and consumer durable goods demand. Under these conditions an output of

more than 140 million ingot tons of steel would be required for 1962, which compares with an actual rate of about 120 million ingot tons in the early part of the year.[1]

If we assume a secular growth in real GNP to be 3½ percent per year, which has been the post-World War II experience, the correlation indicates that steel production would rise 3 percent, or by over 4 million tons per year.

Further, if we assume a secular GNP growth of 4½ percent per year, steel output would rise 4 percent, or over 5 million tons per year.

*Steel shipments lower*

The chart on this page shows the trend of shipments of finished steel products to selected markets which account for roughly 60 percent of total supply. The data shown in the chart are direct shipments from mills to markets and do not represent actual consumption; such figures are not available on a continuous annual basis. Furthermore, many manufacturers supplement their receipts of steel from mills by purchasing additional supplies directly from distributors and warehouses, which in turn move from 15 to 18 percent of the total steel supply, and from foreign sources, which currently account for an additional 4 to 5 percent of the total supply.

It should also be pointed out that during periods of high business activity, manufacturers generally purchase and carry more steel than is actually needed in current operations, as was the case in the 1955–57 period, while in years of business slowdown buying is more cautious and steel users generally reduce their inventories. Despite these qualifications, the shipments data do serve as a guide to indicate some measure of the volume of steel requirements for major markets.

Roughly, two-thirds of all steel shipped from U.S. mills is channeled to producers of capital goods, more than one-fourth is consumed in the manufacture of consumer durables and metal cans, and the remainder 3 to 4 percent goes to export markets.

In 1961 as in other recent years, finished steel shipments to all markets were below the average for the high production period of 1955–57. Last year, they totaled 67 million tons, 4 million tons below 1960 and 15½ million tons under the earlier period. All industries, with the exception of the container market, have reduced their annual takings of finished steel from the record rates of the 1955–57 period. At the end of 1961, however, deliveries of steel to consuming markets were substantially above the average rate for the year.

*Steel for the auto market*

The flow of steel to the motor vehicle industry, which accounts for around 20 percent of steel use, fluctuates for the most part with auto production, apart from shifts in inventory holdings. In 1961, assemblies of 6.6 million passenger cars and trucks, the lowest since 1958, required mill shipments of 12.7 million tons of steel, almost 2 million tons below 1960 and 3.0 million tons below the 1955–57 average, when motor vehicle production averaged 7.8 million units. Actual consumption, however, was probably larger as inventories, high at the start of 1961, were gradually worked off during the year. In the closing months of 1961, when auto production was running close to record levels, deliveries increased to an annual rate of about 16 million tons, a rate exceeding all other years except 1955, the top year of auto production.

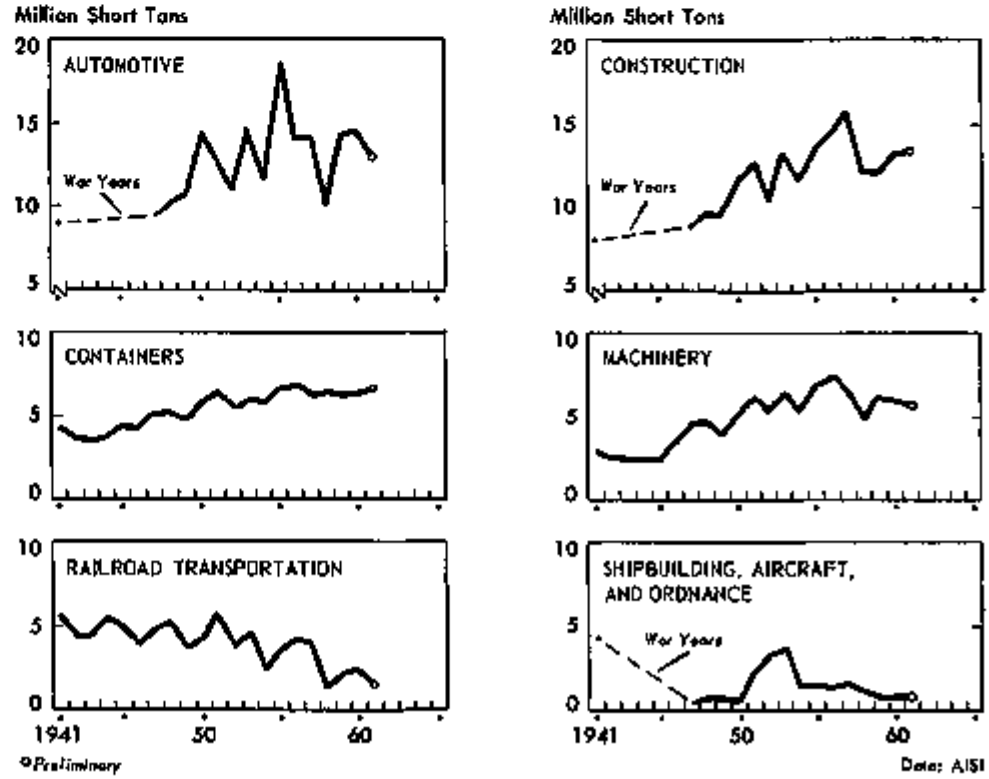
Although steel is the dominant material used in the production of passenger cars, other products are finding increasing usage as substitute materials. These amounts, however, are still small relative to steel, which alone accounts for about two-thirds of the total weight of the average passenger car. Of the newer materials, aluminum is the most important, followed by plastics.

The combined consumption of aluminum (170,000 tons) and plastics (54,000 tons) in the 1961 model cars approximated 224,000 tons, excluding scrap generated in the assembly process. Additional amounts of aluminum are consumed in the production of other transportation equipment such as trucks and buses, truck trailers, and tankers, and trailer coaches.

For the motor vehicle industry as a whole, it is estimated that total aluminum consumption in 1961 was in the

**DIRECT MILL SHIPMENTS OF STEEL PRODUCTS**

Most Markets Have Taken Less Steel Since 1957




*Preliminary

U.S. Department of Commerce, Office of Business Economics

Data: AISI

42-1-6

1. The estimate of over 140 million tons of steel is based on an assumed full-employment GNP of $560 billion in 1962, based on 1961 prices.

neighborhood of 250,000 tons, or about 2 percent of total steel shipments to the industry in all of 1961 and 10 percent of total aluminum consumption.

Notwithstanding the increasing use of substitute materials and the reduction in the size of some passenger cars, direct mill shipments of finished steel to the automotive industry have averaged approximately 2 tons of steel per passenger car and truck produced in the past several years. The explanation for this is that other styling changes have apparently worked in the direction of increased steel consumption per unit of production, such as the increased proportion of 4-door as against 2-door cars, and the increased proportion of station wagons. In addition, with the car population growing, increasing amounts of steel are required for replacement parts and accessories.

### *Construction higher, steel shipments down*

Construction activity, as measured in constant 1954 dollars, has tended higher since 1957 and reached a record volume in 1961. Nevertheless, steel receipts from mills in 1961, as in other recent years, were well below the 1955–57 average. Although the construction industry also purchased an unmeasurable but sizable quantity of steel from warehouses and from foreign producers, it is likely that total receipts of steel were still below the earlier high levels.

In construction and building products, steel faces the broadest range of competitive materials. Concrete, the traditionally competitive line, heads the list, with aluminum and plastics also cutting into the steel market though on a much smaller scale. Of more recent development has been the use of prestressed concrete in certain types of construction, particularly in highway bridge spans up to 60 feet in length. This material, according to trade estimates, is currently displacing some 500,000 tons of steel a year in bridge construction alone.

The construction industry is now the largest market for aluminum, accounting for close to one-fourth of the total supply. In 1958, the use of aluminum in the production of doors, sash, and trim amounted to 185,000 tons; as recently as 1954, the total was under 120,000 tons and in 1947 it was less than 16,000 tons. Consumption of steel, on the other hand, showed only a small increase even though total construction activity almost doubled between 1947 and 1958.

The flow of steel to the machinery industry, where a large part of capital equipment is produced, followed in general the pattern of business investment for new plant and equipment. During 1956 and 1957, the peak years of investment outlays, deliveries of steel to the machinery industry were at record rates, about 7 million tons per year. They dropped sharply during the recession year of 1958 coincident with the exceptionally large reduction in capital spending, and then recovered partially in the ensuing years. Last year's deliveries to the industry came close to 6 million tons but in the October–December period they were running substantially above this rate.

The container industry was the only major steel consumer maintaining its receipts of finished steel products in recent years. Nearly three fifths of the 6½ million tons of steel shipped to this industry is used in the manufacture of food cans. Output of canned fruits, juices, and vegetables and other canned foods has continued at high rates despite the rapid growth in consumption of frozen foods which are packaged largely in paper cartons and polyethylene bags. Here, too, aluminum is being used in place of steel in the production of certain types of food and other cans, but consumption is still small—roughly 30,000 to 35,000 tons in 1961.

### *Rail demand declining*

The railroad transportation industry presents an extreme case where demand for steel has been drifting downward. Faced with diminishing traffic and revenues, and increased competition, investment in new plant and equipment by the railroads has been cut back sharply over the years. Expenditures in 1961, about half as large as in the 1955–57 period, were the lowest since 1946 when they totaled somewhat less than $600 million.

Deliveries of steel to the industry in 1961 of about 1.6 million tons were the lowest in the postwar period with the exception of the 1958 recession year. In 1950, shipments were as high as 5.8 million tons and in the 1955–57 period they still averaged 4 million tons per year. Railroad purchases of new rails have declined steadily since the end of World War II and the demand for steel for freight cars has followed a similar though less pronounced trend. These two markets take the bulk of the industry's steel requirements.

### *Shift in foreign trade*

A marked shift in the steel industry's foreign trade position in steel products has occurred in recent years. Shipments to overseas markets began to fall in 1958 following near record deliveries in the 1955–57 period. They reached a low in 1959 coincident with the prolonged industry-wide steel strike and partially recovered thereafter. Meanwhile, arrivals of foreign produced steel turned sharply upward.

The United States has been a net importer of steel mill products since 1958. Last year, the margin in favor of imports was 1.1 million tons; this compared with nearly 400 thousand tons in 1960 and 2.7 million tons in the steel strike year of 1959. For the 3 year period as a whole, the import balance amounted to 4.2 million tons; by way of contrast, in the 1955–57 period, exports exceeded imports by 10.3 million.

In 1961, exports constituted less than 3 percent of total steel shipments compared with 5½ percent in the 1955–57 period and over 4 percent in the 1950–54 period. The share of imports has increased from a long term average of a little over 1 percent in the 1929–57 period to 4¾ percent currently.

The decreases in exports in the past 4 years occurred in all product lines and were especially severe for pipe and tubing, shapes and plates, bars, and sheets and strip. Most of these items also recorded the largest increases on the import side. These data do not take into account the steel imported in final products, such as autos, which in recent years has become increasingly significant.

### *Conclusion*

The past few years have been years of generally low investment activity

and durable goods production. As a consequence, steel output has tended to lag relative to changes in overall production. However, the current expansion in durable goods and construction demand should result in an improvement in steel output this year both in absolute terms and relative to GNP. Over the longer term, competition from substitute materials and from foreign sources of steel may be expected to intensify, so that the key factors affecting steel demand will be the behavior of durable goods and construction.

This article suggests that by the mid-fifties, the ratio of durable goods and construction had regained, over a period of more than two decades, its long run position relative to GNP. A long term improvement in the ratio of output of such goods to GNP (as well as any factors tending to increase the overall growth rate of the economy, of course) would be favorable for the steel industry's market prospects.

## Inventory Condition

*(Continued from p. 8)*

ber 1961 was less than $\frac{1}{2}$ billion, mostly in nondurables, (see chart). November, however, saw a $300 million rise in inventories.

### *Auto stocks volatile, other durables stable*

Retail inventory movements continued to reflect largely fluctuations in the auto market which are rapidly manifested in the automotive dealers' stocks (see first chart). From a low in August 1958, such stocks rose about 50 percent before reaching a peak in November 1960. The steady growth in the number of new automobiles held by dealers was influenced in large part by the introduction of compacts into the automobile market, a factor which subsequently about doubled the number of car brands offered for sale. The number of new cars in stock rose from around 550,000 in the summer of 1958 to a million in late 1960. With the cyclical decline in sales in the latter months of 1960 stocks held by dealers rose to a high of close to 2 months' supply.

In early 1961 manufacturers trimmed production to bring shipments more nearly in line with demand. Before leveling off in April, dealers' inventories declined more than one-fifth, and then, as noted earlier, held at about 800,000 new cars, seasonally adjusted, through the end of last year. The leveling of stocks was in part related to the automobile strikes that limited production in September and October, while the sharp rise in sales of automobiles in the final quarter of 1961 about matched the rising flow of cars from the factory. The stock-sales ratio declined to 1.6 in December, down about one-fifth from the previous high.

Sales, and consequently, inventory movements at furniture and appliance stores and at lumber, building materials, and hardware dealers in recent years have shown a close association with residential construction activity. From 1959 to 1960 housing outlays declined about one-tenth; beginning late in the first quarter of 1961 the rate of residential construction improved. Sales of furniture and appliances fell off somewhat shortly after housing expenditures peaked in mid-1959 and exhibited weakness throughout 1960. There has been a moderate pick up since the first quarter of 1961. Inventories at these establishments had risen slowly beginning early in 1959 to reach a high of $2 billion in mid-1960. A rapid decline, however, that began in September 1960 brought the book value of inventories down and by April 1961 it was back to that of early 1959. In the past 6 months the inventory holdings in these stores have been quite stable.

Sales by lumber-building materials-hardware dealers had been drifting slowly downward since 1958. Inventories rose slightly between 1959 and 1960 so that the stock-sales ratio rose in the second half of 1960 to a rate averaging about 2.6, a figure not much different from that in the mid-1950's. While sales have been improving since May 1961, inventories were reduced further, lowering the stock-sales ratio to about 2.5.

### *Nondurables—slow growth*

The book value of inventories at most nondurable goods stores is generally at record rates, as are sales. As can be seen in the chart, changes in stocks have tended to almost match sales so that the stock position has slowly slipped from about 1.3 to 1.2 months of sales since the pre-Korean period.

Inventories at food stores, because of the perishable nature of many of the products carried, have a very rapid turnover. This factor tends to hold down the overall stock-sales ratio for all nondurables; the ratios for apparel and general merchandise stores are higher than the average for all durable goods stores. It is interesting to note that despite the fact that many food stores have been increasing their diversification into such nonfood lines as apparel, appliances, books and phonograph records—goods with a considerably slower turnover than food products—the stock-sales ratio has remained relatively stable at 0.7.

### *Apparel and general merchandise stocks*

Apparel stocks had increased from mid-1958 through the end of 1960 to a high of $3.4 billion. There was some decline early in 1961 but thereafter the rise was resumed and by November book values were back to the previous high. Sales, which had shown little buoyancy for two years, strengthened in recent months to reach record rates in the final quarter of 1961. The current stock-sales ratio at apparel stores at 2.9 months has shown no significant trend in the last few years, although it is lower than in the 1955 recovery.

General merchandise sales too showed no appreciable growth in the recent period until the second half of this year. Average sales in the final quarter of last year, seasonally adjusted, rose about 7 percent above the first quarter, with December setting a new high.

Stocks at these establishments, as at apparel stores, rose to a high in the summer of 1960 and then, after a brief period of curtailment, rose once more to new highs by the fall of 1961. The stock position in recent years has been fairly stable at about 2 months of sales. Department store stocks this fall have been slightly higher relative to sales than in the comparable periods in 1958 and 1960.